in the magnetic registers—are separated, it is found that each one in itself varies independently with the variation of sun-spot frequency.

6. Further, there is an annual inequality in the frequency of magnetic disturbance, having maxima at the equinoxes and minima at the solstices, to which there is no counterpart in the variation of sun-spot frequency.

Mean Areas and Heliographic Latitudes of Sun-spots in the year 1898, deduced from Photographs taken at the Royal Observatory, Greenwich, at Dehra Dûn (India), and in Mauritius.

(*Communicated by the Astronomer Royal*).

The results here given are in continuation of those printed in the *Monthly Notices*, vol. lix. p. 4, and are deduced from the measurements of solar photographs taken at the Royal Observatory, Greenwich; at Dehra Dûn, India; and at the Royal Alfred Observatory, Mauritius.

Table I. gives the mean daily areas of umbræ, whole spots, and faculæ for each synodic rotation of the Sun in 1898; and Table II. gives the same particulars for the entire year 1898 and the nine preceding years, for the sake of comparison. The areas are given in two forms: first, projected areas—that is to say, as seen and measured on the photographs, these being expressed in millionths of the Sun's apparent disc; and next, areas as corrected for foreshortening, the areas in this case being expressed in millionths of the Sun's visible hemisphere.

Table III. exhibits for each rotation in 1898 the mean daily area of whole spots, the mean heliographic latitude of the spotted area, and the mean distance from the equator of all spots; and Table IV. gives the same information for the year as a whole, similar results from 1889 to 1897 being added, as in the case of Table II. Tables II. and IV. are thus in continuation of the similar tables for the years 1874 to 1888, on pp. 381 and 382 of vol. xlix. of the *Monthly Notices*.

The rotations in Table I. and Table III. are numbered in continuation of Carrington's series (*Observations of Solar Spots made at Redhill*, by R. C. Carrington, F.R.S.), No. 1 being the rotation commencing 1853, November 9. The assumed prime meridian is that which passed through the ascending node at mean noon on 1854, January 1, and the assumed period of the Sun's sidereal rotation is 25·38 days. The dates of the commencement of the rotations are given in Greenwich civil time, reckoning from mean midnight.

TABLE I.

No. of Rotation.	Date of Commencement of each Rotation.	No. of Days on which Photographs were taken.	Mean of Daily Areas. Projected. Umbræ.	Projected. Whole Spots.	Projected. Faculæ.	Corrected for Foreshortening. Umbræ.	Corrected for Foreshortening. Whole Spots.	Corrected for Foreshortening. Faculæ.
	d							
592	1897 Dec. 28·64	27	103	558	986	74	422	1136
593	1898 Jan. 24·98	28	142	799	969	92	528	1190
594	Feb. 21·32	27	211	1127	1045	147	781	1231
595	Mar. 20·64	27	36	196	755	27	150	866
596	Apr. 16·92	27	47	278	728	39	229	913
597	May 14·16	28	25	159	677	18	115	832
598	June 10·36	27	13	80	562	8	51	666
599	July 7·56	27	38	219	474	28	161	530
600	Aug. 3·77	26	121	657	546	79	437	670
601	Aug. 31·01	27	192	1194	857	134	863	984
602	Sept. 27·28	28	118	732	894	82	553	1007
603	Oct. 24·57	27	142	826	1007	88	516	1077
604	Nov. 20·87	26	62	336	682	48	247	740

TABLE II.

Year.	No. of Days on which Photographs were taken.	Mean of Daily Areas. Projected. Umbræ.	Whole Spots.	Faculæ.	Corrected for Foreshortening. Umbræ.	Whole Spots.	Faculæ.
1889	360	17·9	103	107	13·1	78·0	131
1890	361	21·3	133	273	15·5	99·4	304
1891	363	120	745	1322	86·2	569	1412
1892	362	255	1596	3230	186	1214	3270
1893	362	327	1983	2287	234	1464	2404
1894	364	317	1728	1666	231	1282	1877
1895	364	237	1330	2059	169	974	2278
1896	364	127	745	1243	90	543	1410
1897	364	122	695	977	88	514	1149
1898	363	93	532	767	64	375	891

TABLE III.

No. of Rotation.	Date of Commencement of each Rotation.	No. of Days on which Photographs were taken.	Spots North of the Equator. Mean of Daily Areas.	Spots North of the Equator. Mean Heliographic Latitude.	Spots South of the Equator. Mean of Daily Areas.	Spots South of the Equator. Mean Heliographic Latitude.	Mean Heliographic Latitude of Entire Spotted Area.	Mean Distance from Equator of all Spots.
	d			°		°	°	°
592	1897 Dec. 28·64	27	281	8·61	142	9·60	+ 2·50	8·94
593	1898 Jan. 24·98	28	120	4·72	408	7·70	− 4·86	7·00
594	Feb. 21·32	27	125	10 50	656	11·45	− 7·92	11·30
595	Mar. 20·64	27	0	...	150	11·61	−11·61	11·61
596	Apr. 16·92	27	9	12·68	220	8·59	− 7·76	8·75
597	May 14·16	28	9	9·06	106	12·22	−10·49	11·96
598	June 10·36	27	19	15·13	33	10·06	− 0·85	11·92
599	July 7·56	27	76	10·29	85	12·41	− 1·69	11·41
600	Aug. 3·77	26	194	10·18	243	11·92	− 2·12	11·14
601	Aug. 31·01	27	68	8·25	795	11·69	−10·13	11·42
602	Sept. 27·28	28	164	13·53	389	10·88	− 3·65	11·67
603	Oct. 24·57	27	432	10·32	84	10·84	+ 6·88	10·41
604	Nov. 20·87	26	6	6·19	242	10·92	−10·53	10·81

TABLE IV.

Year.	No. of Days on which Photographs were taken.	Spots North of the Equator. Mean of Daily Areas.	Spots North of the Equator. Mean Heliographic Latitude.	Spots South of the Equator. Mean of Daily Areas.	Spots South of the Equator. Mean Heliographic Latitude.	Mean Heliographic Latitude of Entire Spotted Area.	Mean Distance from Equator of all Spots.
1889	360	5·0	7°·26	73·0	11°·90	− 10°·68	11°·61
1890	361	53·1	22·20	46·3	21·75	+ 1·73	21·99
1891	363	401	20·49	169	19·91	+ 8·52	20·31
1892	362	607	15·09	607	21·69	− 3·29	18·39
1893	360	517	14·91	941	14·26	− 3·93	14·49
1894	364	543	12·31	739	15·56	− 3·75	14·18
1895	364	565	14·26	409	12·54	+ 3·01	13·54
1896	364	203	13·60	340	14·77	− 4·15	14·33
1897	364	196	8·32	318	7·73	− 1·62	7·96
1898	363	110	9·82	266	10·77	− 4·75	10·49

The principal features of the record for 1898 are :—

1. The decline in area of umbræ and whole spots, which seemed to have suffered a check in 1897, had resumed its regular course. The decrease in mean daily spotted area amounted to 27 per cent. for 1898 as compared with 1897, and to 31 per cent. as compared with 1896.

2. The decrease in the area of the umbræ has been in almost exactly the same proportion as for the whole spots—27 per cent. as compared with 1897, 29 per cent. as compared with 1896.

3. The decrease in the area of the faculæ has also been considerable—22 per cent. as compared with 1897, 37 per cent. as compared with 1896.

4. The decline in the whole spots has been chiefly in the northern hemisphere, the decrease as compared with 1897 being 44 per cent. for the northern hemisphere, but only 16 for the southern.

5. The predominance in spot activity of the southern hemisphere, noted in 1897, has become more striking in 1898.

6. The year has been marked by three chief outbreaks of spots. The first began on March 6, with the simultaneous appearance, at equal distances from the equator, of two fine groups in the same longitude, but one north and the other south of the equator. The greatest group of the year made its first appearance as one or two very small faint spots on August 11, and was quite insignificant up to the time of its disappearance at the W. limb after August 16. It had become a magnificent group by its return on September 3, and was still rapidly increasing. It attained its greatest area, 2,235 millionths of the visible hemisphere, on September 10, and then began to decline. It was still a fine group at its third appearance on September 30, but was rapidly diminishing, and at its fourth return on October 28 only a few small spots remained. The third chief group of the year was first seen on October 22, but appeared only for a single passage.

7. The chief characteristic of the year 1898 has been the return to a higher mean distance of the spots from the equator—viz., to 10°·5 instead of 8° in 1897. As this latitude accords well with that usually occupied by the spots at this stage of the decline towards minimum, 1897 stands out as having been quite abnormal, both as to its slight decline in area and its great decline in latitude.

8. The number of days without spots has increased, being 48 for 1898, as against 32 in 1897 and 8 in 1896. The number of days without faculæ was 11.

9. The year 1898 closely resembles the year 1886 as to mean daily spotted area, mean distance of spots from the equator, and number of days without spots. If the decline follows the course of the last cycle the next minimum should fall towards the end of 1901.

Observations of the Leonid Meteors of 1899 *made at the Royal Observatory, Greenwich.*

(*Communicated by the Astronomer Royal.*)

Twenty meteors were observed in the morning of November 16, two of these during a partial break between 4.30 and 4.40 A.M., and the other eighteen during a clear period between 5.30 and 6.15 A.M. Thirteen of these meteors conformed to the *Leo* radiant. A continuous watch by three observers was kept from 11 P.M. to 6 A.M. on November 14–15 and November 15–16, but dense fog on the former night and cloud on the latter prevented any observations except during the above-mentioned periods.

Arrangements were also made to photograph meteors on the two nights, but owing to the weather no results were obtained.

A watch was also kept for the Bielid meteors on the nights of November 23 to 27, but the sky was generally covered with cloud, and no meteors were seen.

The following table shows the number of meteors seen at the Leonid epoch in each of the years 1887 to 1899 at Greenwich :—

Year.	Date of Observation.	Length of effective Watch.	Total Number of Meteors.	Number of Leonids.	Remarks.	No. of Observers.
1887	Nov. 15	A few minutes	2	1	Cloudy	1
1888	...	...	...	...	Quite cloudy	...
1889	Nov. 12–13	2^h	7	0	Cloudy generally	1
1890	...	...	...	...	Quite cloudy	...
1891	Nov. 13–14	2^h	0	0	Generally clear; bright moonlight	1
1892	Nov. 12–13	$1\frac{1}{2}^h$	0	0	Thin cloud	1
	,, 14–15	Brief	1	0	Cloudy generally	1
1893	Nov. 12–13	3^h	21	4	...	1
	,, 13–14	$1\frac{1}{2}^h$	9	1	Watch suspended on account of cloud	2
1894	...	...	...	...	Cloudy throughout	...
1895	Nov. 12–13	4^h	30	5	...	2
	,, 13–14	2^h	19	7	Observations stopped by cloud	2
1896	Nov. 12–13	2^h	8	2	...	3
	,, 15	$1\frac{1}{2}^h$	10	5	...	1
1897	Nov. 14	2^h	14	8	...	3
1898	Nov. 15–16	Brief	1	1	Cloudy	1
1899	Nov. 16	1^h	20	13	Cloudy	3+

Royal Observatory, Greenwich :
1899 *December* 8.